CLAIMS

1. A separation process for platinum group elements comprising:

a step (A) for treating a material containing selenium/tellurium and platinum group elements with alkali,

a step (B) for leaching selenium/tellurium, and

a step (C) for separating a platinum group element-containing leaching residue and a selenium/tellurium leachate.

2. A separation process according to claim 1, wherein

said step (A) for treating a material containing selenium/tellurium and platinum group elements with alkali is a step in which a flux comprising a mixture of caustic soda and sodium nitrate is added to said material containing selenium/tellurium and platinum group elements, and a resulting mixture is melted by heating to a temperature exceeding a eutectic temperature of said flux,

said step (B) for leaching selenium/tellurium is a step for leaching an obtained melt with water, and

said step (C) for separating said platinum group element-containing leaching residue and said selenium/tellurium leachate is a step for conducting a solid-liquid separation using water leaching, thus separating a mixture into a liquid fraction containing sodium selenite, and a residue containing platinum group elements.

3. A separation process according to claim 2, wherein

a molar ratio between said caustic soda and said sodium nitrate is within a range from 75:25 to 85:15.

4. A separation process according to claim 2, wherein

hydrogen peroxide and hydrochloric acid are added to said residue containing platinum group elements to dissolve said platinum group elements.

5. A separation process according to claim 2, wherein

said material containing selenium/tellurium and platinum group elements is an extraction residue process precipitate left after a solvent extraction has been used to separate gold from a hydrochloric acid leachate from a decoppered slime.

6. A separation process according to claim 2, wherein

said material containing selenium/tellurium and platinum group elements is a distillation residue produced by converting a decoppered slime to a slurry by adding hydrochloric acid and hydrogen peroxide, filtering said slurry to effect a separation into a leaching residue containing primarily silver, and a leachate containing gold, platinum group elements, selenium and tellurium, subsequently adjusting liquid characteristics of said leachate and then using a solvent extraction to separate gold from said leachate, adding sulfur dioxide to a post-gold extraction liquid to sequentially reduce and precipitate out selenium and then tellurium, and then heating said precipitated material containing platinum group elements and selenium to concentrate the platinum group elements, while distilling and separating off selenium.

7. A separation process according to claim 1, wherein

said step (A) for treating a material containing selenium/tellurium and platinum group elements with alkali, and said step (B) for leaching selenium/tellurium are conducted simultaneously as an alkali leaching process, in which said material containing selenium/tellurium and platinum group elements is leached with alkali at high temperature, causing selenium/tellurium to migrate into an alkali liquid, and a solid-liquid separation is then conducted to separate a resulting mixture into a solid fraction containing platinum group elements, and a liquid fraction containing selenium/tellurium.

8. A separation process according to claim 7, wherein

hydrochloric acid and an oxidizing agent are added to a separated solid fraction generated in said solid-liquid separation, thus dissolving said platinum group elements.

9. A separation process according to claim 7, wherein

said material containing selenium/tellurium and platinum group elements is leached with alkali at high temperature, causing tellurium to migrate into said alkali liquid with selenium, thus effecting a separation from said platinum group elements.

10. A separation process according to claim 7, wherein

said material containing selenium/tellurium and platinum group elements is leached using an alkali concentration of at least 1 mol/L, at a temperature of at least 60°C.

11. A separation process according to claim 7, wherein

hydrochloric acid and either hydrogen peroxide or chlorine gas are added to said solid fraction from said solid-liquid separation performed after said alkali leaching, thus dissolving said platinum group elements.

12. A separation process according to claim 7, wherein

said platinum group elements comprise one or more of rhodium, ruthenium, palladium and platinum.

13. A separation process according to claim 7, wherein

said material containing selenium/tellurium and platinum group elements is an extraction residue process precipitate left after a solvent extraction has been used to separate gold from a hydrochloric acid leachate from a decoppered slime.

14. A separation process according to claim 7, wherein

said material containing selenium/tellurium and platinum group elements is a filtered precipitate oduced by converting a decoppered slime to a slurry by adding hydrochloric acid and hydrogen peroxide, filtering said slurry to effect a separation into a leaching residue containing primarily silver, and a leachate containing gold, platinum group elements, selenium and tellurium, subsequently adjusting liquid characteristics of said leachate and then using a solvent extraction to separate gold from said leachate, adding sulfur dioxide to a post-extraction liquid to precipitate either selenium/tellurium, and then subjecting said precipitate to solid-liquid separation.

15. A separation process according to claim 7, comprising:

an alkali melt process (i), comprising a step for adding a flux comprising a mixture of caustic soda and sodium nitrate to a residue from a distillation treatment of a material containing selenium/tellurium and platinum group elements, and then heating to

a temperature exceeding a melting (eutectic) temperature of said mixture, thus dissolving said selenium/tellurium, as said step (A) for conducting said alkali treatment, a step for conducting water leaching as said step (B) for leaching selenium/tellurium, and further comprising said step (C) for separating said platinum group element-containing leaching residue and said selenium/tellurium leachate, and

an alkali leaching process (ii), comprising a step for leaching a material containing selenium/tellurium and platinum group elements with alkali at high temperature as said step (A) for conducting said alkali treatment and said step (B) for leaching selenium/tellurium, and further comprising said step (C) for separating said platinum group element-containing leaching residue and said selenium/tellurium leachate.

16. A separation process according to claim 15, wherein

a solution containing selenium/tellurium and platinum group elements is subjected to a reduction treatment, and a residue generated by subjecting a portion of a resulting reduction precipitate to distillation treatment is then subjected to alkali melt treatment, while remaining reduction precipitate is subjected to alkali leaching treatment.

17. A separation process according to claim 15, wherein

sulfur dioxide gas is introduced into a post-gold extraction liquid of a noble metal recovery system for copper electrolysis slime to effect a reduction treatment, and a residue, generated by subjecting a selenium that precipitates first to distillation to effect a separation of high purity selenium, is subjected to alkali melt treatment, whereas a tellurium that precipitates next is subjected to alkali leaching treatment.

18. A separation process according to claim 15, wherein

a leachate obtained in said water leaching of said alkali melt process is recycled to said alkali leaching process, and subjected to alkali leaching together with a material containing selenium/tellurium and platinum group elements.

19. A separation process according to claim 15, wherein

a leachate obtained in said alkali leaching process is neutralized by adding sulfuric acid or hydrochloric acid, thus precipitating selenium/tellurium.

20. A separation process according to claim 15, wherein

hydrochloric acid is added to a leaching residue generated in said alkali leaching process and said alkali melt process in presence of an oxidizing agent, thus dissolving said platinum group elements.

21. A separation process according to claim 1, wherein

a selenium/tellurium mixture is obtained from said selenium/tellurium leachate, and said obtained selenium/tellurium mixture is then introduced into a copper smelting and refining process to generate an alloy of selenium and tellurium with copper, said alloy is subjected to copper electrolysis to recover electrolytic copper, while accumulating selenium and tellurium within a copper electrolysis slime, and said copper electrolysis slime is then subjected to sulfuric acid oxidizing leaching, thus dissolving and separating tellurium in a leachate from selenium in a leaching residue.

22. A separation process according to claim 7, wherein

a selenium/tellurium mixture is obtained by adding sulfuric acid or hydrochloric acid to a selenium/tellurium leachate obtained in said alkali leaching process, thus neutralizing said leachate and precipitating said selenium/tellurium mixture, and said obtained selenium/tellurium mixture is then introduced into a copper refining process to generate an alloy of selenium and tellurium with copper, said alloy is subjected to copper electrolysis to recover electrolytic copper, while accumulating selenium and tellurium within a copper electrolysis slime, and said copper electrolysis slime is then subjected to sulfuric acid oxidizing leaching, thus dissolving and separating tellurium in a leachate from selenium in a leaching residue.

23. A separation process according to claim 15, wherein

a selenium/tellurium mixture is obtained by adding a selenium/tellurium leachate obtained in said alkali melt process to a material containing selenium/tellurium and platinum group elements used in said alkali leaching process, subsequently conducting alkali leaching, and then adding sulfuric acid or hydrochloric acid to a resulting leachate to neutralize said leachate and precipitate said selenium/tellurium mixture, and said obtained selenium/tellurium mixture is then introduced into a copper smelting and refining process to generate an alloy of selenium and tellurium with copper, said alloy is

subjected to copper electrolysis to recover electrolytic copper, while accumulating selenium and tellurium within a copper electrolysis slime, and said copper electrolysis slime is then subjected to sulfuric acid oxidizing leaching, thus dissolving and separating tellurium in a leachate from selenium in a leaching residue.

24. A separation process according to claim 21, wherein

said material containing selenium/tellurium and platinum group elements is a reduction precipitate produced by introducing sulfur dioxide gas into a post-gold extraction liquid and conducting a reduction treatment.

25. A separation process according to claim 21, wherein

following a leaching of tellurium by sulfuric acid oxidizing leaching of said copper electrolysis slime, a resulting leachate is contacted with metallic copper, generating copper telluride which is subsequently recovered.

26. A separation process according to claim 1, wherein

hydrochloric acid is added to said platinum group element-containing leaching residue in presence of an oxidizing agent, a solid-liquid separation is conducted, and hydroxylamine hydrochloride is then added to a resulting filtered platinum group element-containing solution to selectively reduce and precipitate gold.

27. A separation process according to claim 26, wherein

alkali treatment of a material containing selenium/tellurium and platinum group elements is conducted at high temperature.

28. A separation process according to claim 2, wherein

hydrochloric acid is added to said residue containing platinum group elements in presence of an oxidizing agent, a solid-liquid separation is conducted, and hydroxylamine hydrochloride is then added to a resulting filtered platinum group element-containing solution to selectively reduce and precipitate gold.

29. A separation process according to claim 26, wherein

a post-gold extraction liquid of a noble metal recovery system for copper electrolysis slime is used as a material containing selenium/tellurium and platinum group elements, and sulfur dioxide gas is introduced into said post-gold extraction liquid to effect a reduction treatment, and a distillation residue generated by subjecting a selenium that precipitates first to distillation to effect a separation of high purity selenium is subjected to alkali melt treatment to separate a residue containing platinum group elements, whereas a tellurium that precipitates on further sulfur dioxide gas introduction into said post-gold extraction liquid is subjected to alkali leaching treatment to separate a residue containing platinum group elements, and said residues containing platinum group elements are then combined and used.